

## Description of Additional Supplementary Files

**Supplementary Movie 1.** Volumetric image of a phantom, which had an absorption coefficient of  $0.05 \text{ cm}^{-1}$  and a reduced scattering coefficient of  $7 \text{ cm}^{-1}$  to mimic the bulk optical properties of human breast tissue at 1064 nm wavelength. Three human hair fibers were embedded in the phantom. The total imaging depth along the elevational direction (z-axis) was  $\sim 5.2 \text{ cm}$ . Tick mark: 1 cm.

**Supplementary Movie 2.** *In vivo* photoacoustic computed tomography of a healthy breast, visualizing the angiographic anatomy from the nipple to the chest wall. The entire volumetric image was acquired within a single breath hold ( $\sim 15 \text{ sec}$ ).

**Supplementary Movie 3.** Arterial pulsatile deformation inside a breast. In the right panel, the normalized pixel value fluctuation in one artery and one vein are co-plotted.

**Supplementary Movie 4.** Photoacoustic computed tomography of a breast cross section showing minor deformations caused by breathing. The right panel is a co-plot of the relative area changes in selected triangular grids (red, tumor; blue, normal tissue).